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1. TITLE OF INVENTION

HRL OAR

SHEET 1 OF 8

AudioOnLocation

2. INVENTOR(S)

NAME	PAYROLL NO.	SOURCE CODE	LOC	BLDG	MS	PHONE	MANAGER
Mike Daily	A0978	30-21-20	MA	254	RL96		Mark Stalzer
Kevin Martin	56859	30-21-20	MA	254	RL96	317-5687	Mike Daily
Timothy Hirzel	N/A	Intern	MA	254	RL96		Mike Daily
			MA	254	RL96		

This is to acknowledge that the above Invention Disclosure has been received by HRL Laboratories, LLC Patents and Licensing. The disclosure will be reviewed at the next Evaluation Committee Meeting of your organization and you will be promptly informed of the results. If you have any questions please contact the patent attorney listed on the bottom of this form.

This sheet will be returned to the inventor(s) as a confirmation of receipt by HRL Laboratories, LLC Patents and Licensing.

LOSS OF RIGHTS THROUGH RELEASE TO THE PUBLIC

The right to apply for and obtain a valid patent may be lost as the result of certain activities, such as (1) disclosing the invention outside of the company without an appropriate confidentiality agreement with the receiving party; (2) using the invention publicly; (3) using the invention privately to build or test items that are to be sold publicly; or (4) putting the invention "on sale" by selling or offering for sale an item or product that embodies or uses the invention, or is made or tested by use of the invention. Submitting a proposal with the intent to use the invention in the performance of a resulting contract puts the invention "on sale." Please inform me immediately of any of these activities or any plans to undertake any of them.

ASSIGNED ATTORNEY: _____ PHONE ( ) _____

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Michael D Daily — SIGNATURE INVENTOR — 7/26/99 DATE

Kevin R Martin — SIGNATURE INVENTOR — 7/26/99 DATE

T. Hirzel — SIGNATURE INVENTOR — 7/26/99 DATE

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Timothy Hirzel	N/A	30	21	20	MA	254	RL96		Mike Daily
		30	21	20	MA	254	RL96		

3. PROOF ON CONCEPTION

A. BY WHOM WAS FIRST DESCRIPTION WRITTEN OR DRAWING MADE?	DATE	TIME SPENT	ACCT. CHARGED	LOCATION OF FIRST DESCRIPTION / DRAWING
Mike Daily	5/26/99	2 hours	CD192A1AL	Daily's Computer
B. TO WHOM WAS INVENTION FIRST DISCLOSED?	**DATE**			
Kevin Martin	5/26/99			

4. REDUCTION TO PRACTICE

A. WAS A DEVICE EMBODYING THE INVENTION CONSTRUCTED AND TESTED OR THE PROCESS PRACTICED?	YES X / NO	BY WHOM	DATE STARTED	DATE COMPLETED	TIME SPENT
		Daily, Martin, Hirzel	6/1/99	7/22/99	200 hours

B. ACCOUNT CHARGED — TIME	ACCOUNT CHARGED — MATERIAL	PRESENT LOCATION OF DEVICE
CD192A1AL	CD192A1AM	HRL Bldg 254, 3G21

C. PRESENT LOCATION OF DOCUMENTS (DATE SIGNED AND WITNESSED), INCLUDING PHOTOS, DRAWINGS, AND DATA SHEETS SHOWING REDUCTION TO PRACTICE: Notes on Daily's computer

NOTE: ALL EVIDENCE OF CONCEPTION (FIRST DRAWING AND FIRST WRITTEN DESCRIPTION) AND EVIDENCE OF REDUCTION TO PRACTICE (DEVICE EMBODYING THE INVENTION AND TEST DATA) MUST BE RETAINED.

5. RELATION TO GOVERNMENT CONTRACT

	YES / NO	CONTRACT NUMBER AND TITLE
A. DOES THIS INVENTION RELATE TO WORK PERFORMED UNDER A GOVERNMENT CONTRACT?	NO X	
B. IS INVENTION BEING USED ON A GOVERNMENT CONTRACT?	NO X	

6. RELATED DOCUMENTS AND DISCLOSURE (BY YOU OR BY ANOTHER). PLEASE ATTACH COPY.

	YES / NO	DATE	IDENTIFY
A. IS THERE A PUBLICATION OR PUBLIC PRESENTATION RELATED TO THE INVENTION?	YES ☐ NO X		
B. ARE THERE ANY RELATED INVENTION DISCLOSURES OR PATENT APPLICATIONS?	NO X	DATE	IDENTIFY PD NO. ETC.

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Kevin R. Martin — SIGNATURE INVENTOR — 7/26/99 DATE

[illegible] — SIGNATURE INVENTOR — 7/26/99 DATE

SIGNATURE INVENTOR — DATE

READ AND UNDERSTOOD BY:

Bruce Hoff — WITNESS NAME (TYPE) — [signature] SIGNATURE — 7/26/99 DATE

Dave Payton — WITNESS NAME (TYPE) — [signature] SIGNATURE — 7/26/99 DATE

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C. ARE THERE ANY PROPOSALS OR REPORTS OR OTHER DOCUMENTS RELATING TO THIS INVENTION	YES NO X	DATE	IDENTIFY
D. HAS THE INVENTION BEEN USED, DISCUSSED, DEMONSTRATED OR OTHERWISE DISCLOSED OUTSIDE THE COMPANY (SUCH AS TO A VENDOR OR CUSTOMER)?	YES NO X	DATE	TO / FOR WHOM (COMPANY / PERSON)

7. SALE

A. HAS PRODUCT EMBODYING INVENTION OR MADE BY INVENTION BEEN PROPOSED, SOLD, OR OFFERED FOR SALE?	YES ☐ NO X	ORDER NO.	ORDER DATE	DELIVERY DATE	DATE OFFERED OR PROPOSED	
B. IS PRODUCT EMBODYING INVENTION OR MADE BY INVENTION IN A DELIVERABLE ITEM?	YES ☐ NO X	DELIVERY DATE				

8. SUMMARY OF THE INVENTION

A. GIVE A BRIEF DESCRIPTION OF YOUR INVENTION, PARTICULARLY POINTING OUT WHAT IS BELIEVED TO BE NOVEL (THE "HEART" OF WHAT IS NEW).

This invention describes the system needed to enable mobile users to place and access audio and other information at locations in the environment. The novel aspect of the system is the unique convergence of technologies that provide a real time publicly (or controlled, privately) accessible "whiteboard" of audio and other information types delivered as audio. Both mobile and fixed users can add location specific information to a distributed web-based server that is then accessible by users based on a variety of location based queries. The system requires no additional infrastructure such as special devices or networks and enables real time location specific annotations and information. Figure 1 shows the overall system concept.

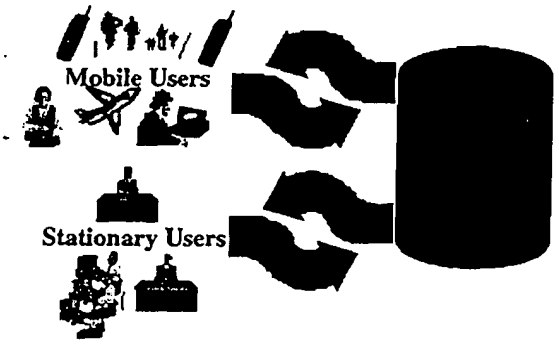

Figure 1: Real time location embedded audio with no added infrastructure supporting stationary and mobile users.

B. EXPLAIN THE PURPOSE AND ADVANTAGES OF YOUR INVENTION. (WHAT WILL THE INVENTION DO BETTER THAN DONE PREVIOUSLY?)

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Ken R Hoff — SIGNATURE INVENTOR — 7/26/99 DATE

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AudioOnLocation enables users to hear audio that is virtually embedded in places with context as they move through the environment. It allows the user to annotate places with audio in real time, from either fixed or mobile systems, that is then stored in a server and can be accessed remotely from fixed systems or as the user moves to new locations or points in the direction of previously annotated objects or places.

Previous systems suffer from a variety of deficiencies that require external infrastructure to enable user tracking, use very coarse position information (such as cellular systems), can not use orientation information, do not enable real time access to new information, and do not enable users to add new information. Our system enables any user to access embedded audio attached there by any other user. It also provides a real time method for placing new annotations on places in the environment which previous systems do not allow.

C. IDENTIFY THE COMPANY PROGRAM OR PRODUCT LINE TO WHICH THE INVENTION APPLIES, AND THE EXPECTED VALUE TO THE PROGRAM OR PRODUCT LINE. ALSO IDENTIFY POTENTIAL COMMERCIAL APPLICATION OF THIS INVENTION, INCLUDING AUTOMOTIVE APPLICATIONS, IF ANY.

This system will have direct applicability to soldier technologies including Land Warrior, SUOSAS, Special Forces, and mobile command and control by enabling rapid smart environment audio infrastructure for communication and situation awareness.

In addition, the capability can be applied within automobiles or other moving vehicles to enable smart highway communication with driver. Advanced cell phones with location awareness will also take advantage of this system functionality, as will rapid infrastructure to support education, museums, etc. A large number of location specific information services are possible with such a system.

D. IDENTIFY THE PRIOR ART KNOWN TO YOU WHICH IS IMPROVED UPON OR DISPLACED BY YOUR INVENTION, AND STATE IN DETAIL, IF KNOWN, THE DISADVANTAGES OF THE CLOSEST PRIOR ART.

Museums employ an active system with either user initiated audio from tape recorders at known locations or active infrared communication between fixed infrastructure and modified tape recorder playback devices. These do not enable widespread use, user annotation, device or user tracking, real time updates, or a variety of advanced functions possible with more capable playback using mobile, wearable computing. They also require fixed, static hardware and software infrastructure with certain higher maintenance costs.

AirFlash.com will offer a service for mobile phone users later this year that provides business, entertainment, and travel information specific to a user's location. This system is based on a cell phone user's known position location determined by which antenna is used to access the network, allowing search results to be tailored to a user's location. It does not provide accurate position information or orientation sensitivity. Some ability to access any geographic information is provided through a database service, which could also be used by this invention.

9. DETAILED DESCRIPTION

DESCRIBE YOUR INVENTION IN DETAIL, USING NECESSARY ADDITIONAL SHEETS

A. BE SURE THAT EACH SHEET IS DATED, AND SIGNED BY EACH INVENTOR AND TWO WITNESSES. (HRL FORM 236C-6 CS SHOULD BE USED, IF PRACTICAL).

B. ATTACH COPIES OF DRAWINGS OR DETAILED REPORTS HELPFUL IN UNDERSTANDING HOW YOUR INVENTION WORKS

C. IF YOUR INVENTION HAS BEEN TESTED, BRIEFLY SUMMARIZE THE TEST RESULTS WHICH CONFIRM THE FUNCTIONS AND ADVANTAGES LISTED IN 8 B ABOVE.

AudioOnLocation is a system that enables mobile users to obtain audio information that is context and location dependent. It also provides the necessary infrastructure to enable any user at any location to embed audio in specific locations that can then be accessed by other users either from that location using special information access appliances, or from any remote location using a variety of interfaces through the World Wide Web. Figure 2 below shows the sequence of operations (and optional operations) that occur when the system is used to retrieve audio either via explicit or implicit (push) request.

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SIGNATURE INVENTOR		DATE
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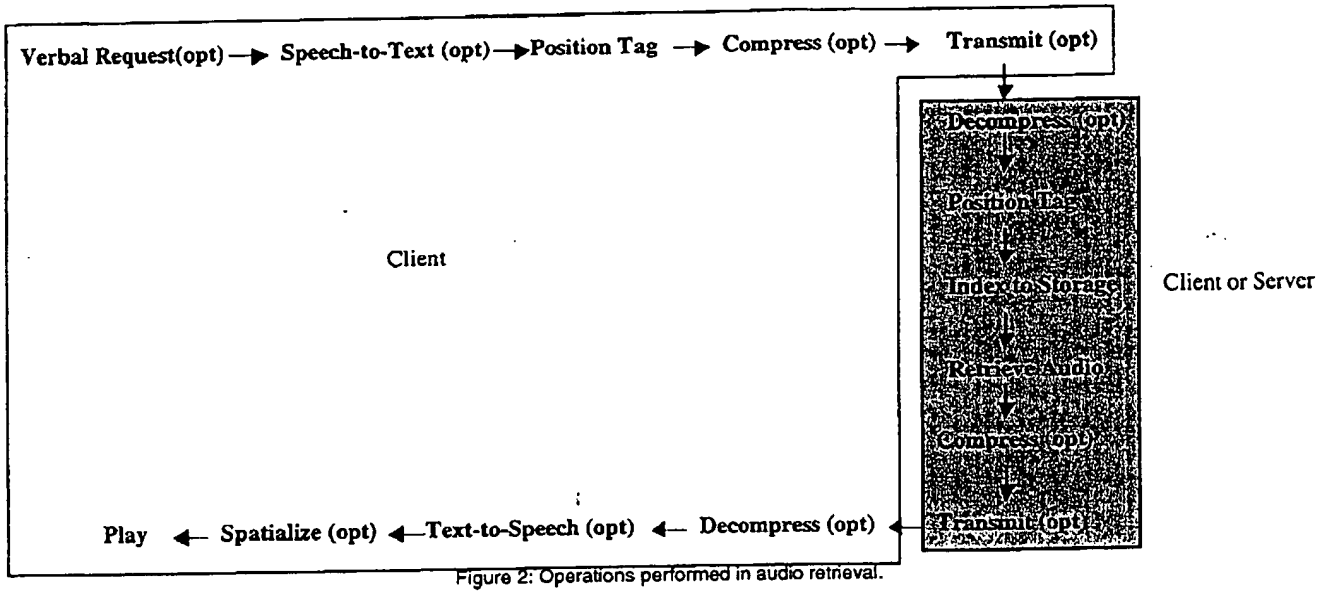

Figure 2: Operations performed in audio retrieval.

In the simplest case, the system requires user input of position manually. The AudioOnLocation Information Server then retrieves audio and if remote, sends it to the client which plays it. The client and server may be on the same computer wherever the user is located, or the server may be distributed at remote locations and be connected via wireless or cellular networks to the client:

The system may be used in an information push mode where user location is constantly streamed to the server (local or remote) and the server automatically identifies and sends the audio to the client based on predetermined parameters such as distance from current position.

A more advanced use of AudioOnLocation enables explicit querying of the Information Server based on position and orientation of the user's hand held or body worn device. In this case, the user designates an object or region of interest from a remote position. The system determines what objects are potentially of interest using the user's current position and the pointing vector and retrieves and plays them.

The AudioOnLocation Information Server is composed of the following software functions (shown graphically in Figure 3):

1) User Interface: This function provides the user with the ability to selectively control the scope and generation of queries using voice, keyboard, touch pad or other input device. It also allows the user to provide relevant information in the form of preferences to aid in selecting and controlling the audio playback messages. The user may explicitly provide a position.

2) Position Sensors: A variety of complementary sensors provide the user's position and, optionally, orientation (a six dimensional vector) to the position manager.

3) Content Manager: This function receives content from the User Interface and sends links to content to the Database Update Manager. It sends the content (file) to the content pool. These functions are separated to enable distributed management and storage of the content.

4) Position Manager: This function takes any user supplied position data or alternatively, position data from sensors and sends it to the database update manager to be linked with the current recorded content, and to the database query manager.

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Timothy Kindl		7/26/99
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5) Database Update Manager: This function matches the content reference and the position data and updates the database.

6) Database Query Manager: The query manager uses position data to query the database and sends the references to the playback manager. It also contains a filtering mechanism that uses preferences from the user to identify specific types of information that will be of interest to users. Classes of information might include public, private, business (e.g. restaurant, commerce), navigation, and general.

7) Playback Manager: This function uses a content reference to retrieve content from the pool and then send it to the user interface. The audio may be spatially enhanced to appear to be coming from the area or object with which the audio was associated. In cases where only textual information is associated with a location, the user has the option of displaying the text or having the text automatically translated into an audible spoken language.

8) User Preference Manager: This function takes user preferences (either explicitly provided by the user or determined automatically by the system) and supplies appropriate information to the database query manager to enable content references to the correct content. Preferences include search range from current location, error in position, playback features, network or cellular connectivity constraints, etc.

9) Content Pool: The audio, text, or other information is stored as files referenced by URL and may be local or remote (completely distributed) from the other system components.

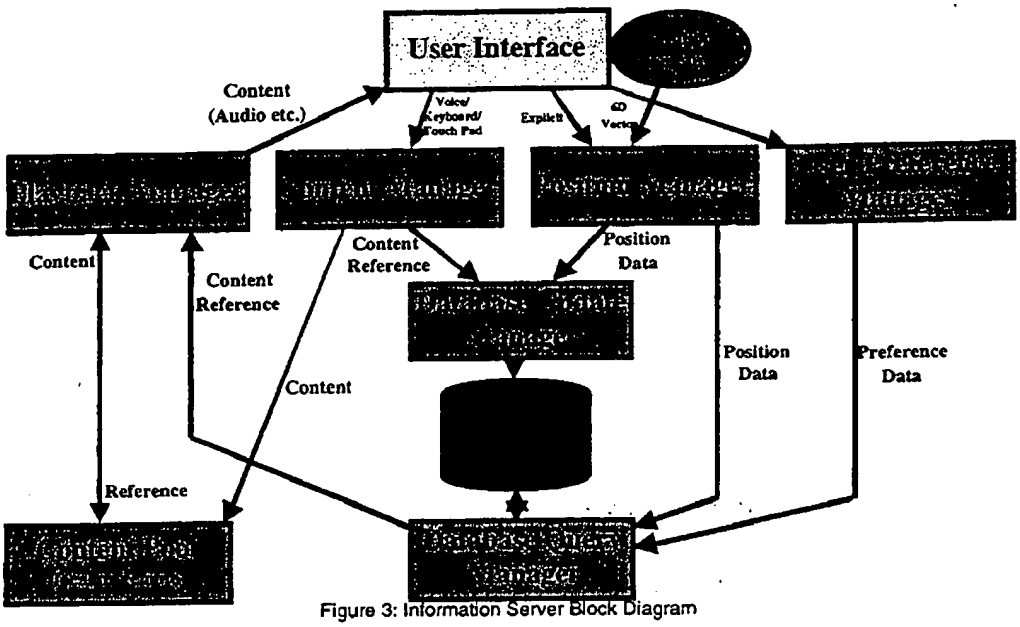

Figure 3: Information Server Block Diagram

In one preferred embodiment of the invention, a user with a mobile phone and GPS (such as the Garmin NavTalk product) dials the number for the AudioOnlLocation Information Server. Figure 4 shows the user's interaction with the Information Server through an automatic call answering service for the simplest case in which there is only one item of information within the desired range of the user's position.

Figure 5 shows a slightly more complex case in which the user hears a menu of items that allow selection of specific information types or system functions. In this case, the user selects to hear all the current audio and might hear something like "There are 5 information items within 20 meters of your current

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position. You may choose to listen to any one of them by entering the number of the item followed by the # sign." The user enters a number for the item which is retrieved from the server and played through the cell phone line as analog audio.

Figure 6 shows a case where a user chooses from a menu of items that allows the user to speak an audio annotation at the user's current position that is placed in the AudioOnLocation Information Server.

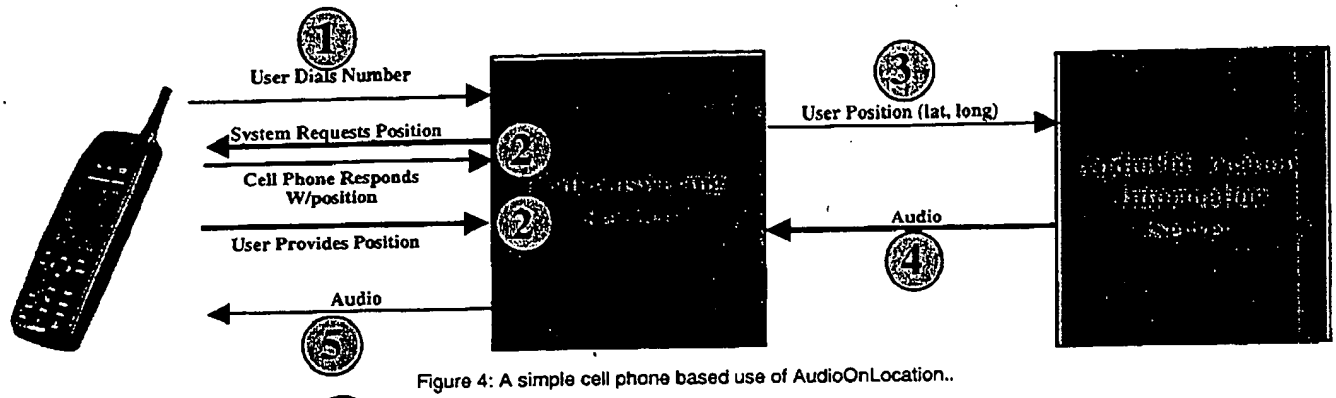

Figure 4: A simple cell phone based use of AudioOnLocation..

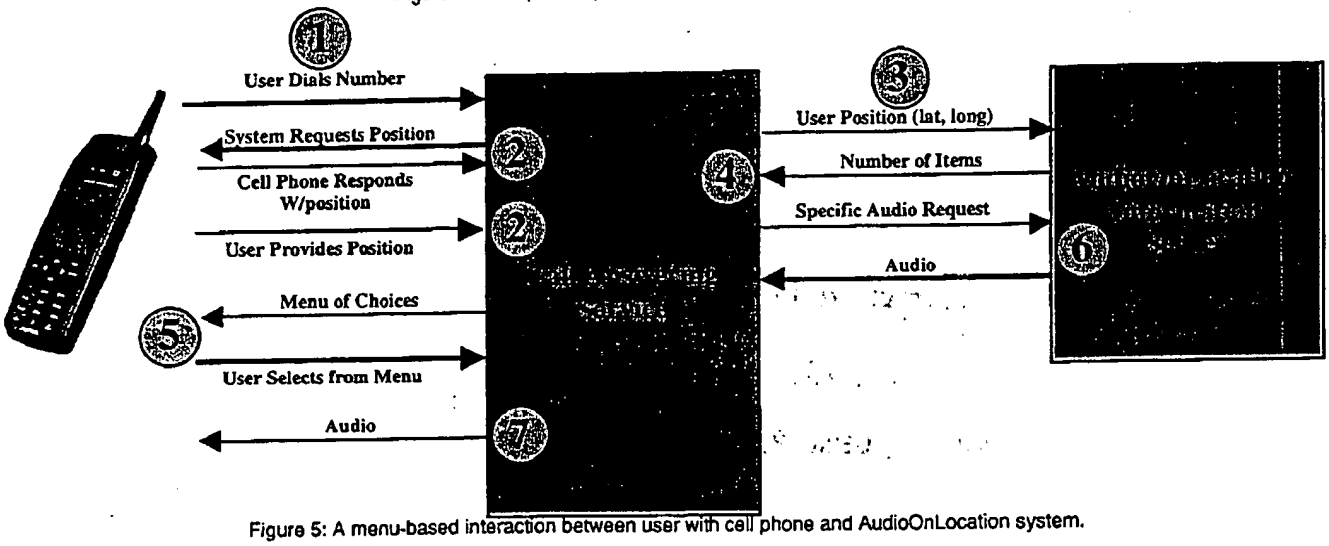

Figure 5: A menu-based interaction between user with cell phone and AudioOnLocation system.

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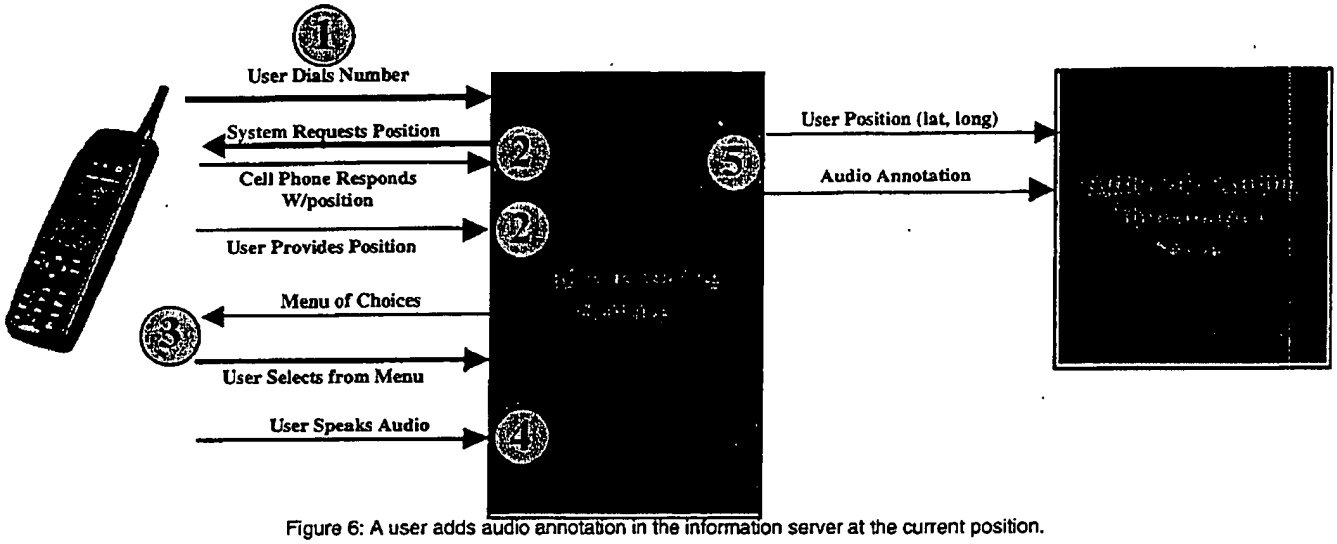

Figure 6: A user adds audio annotation in the information server at the current position.

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	SIGNATURE INVENTOR	DATE

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